# Application of Nitrogen for Grass Seed Production -- Does It Still Pay?



OREGON STATE UNIVERSITY
EXTENSION SERVICE

Special Report 435 April 1975

Extension Service, Oregon State University, Corvallis, Joseph R. Cox, director. This publication was produced and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Extension work is a cooperative program of Oregon State University, the U. S. Department of Agriculture, and Oregon counties.

# APPLICATION OF NITROGEN FOR GRASS SEED PRODUCTION - DOES IT STILL PAY?

William G. Brown, T. L. Jackson, and Harold W. Youngberg*

## SUMMARY AND CONCLUSIONS

This brief economic analysis of several grass seed experiments indicates that it does still pay to apply nitrogen for grass seed production. However, with present (Spring 1975) depressed grass seed prices and high commercial fertilizer costs, it no longer pays to try to fertilize for maximum production on the lower priced grass seeds. But even for annual ryegrass seed production under present price conditions, the response to nitrogen (obtained from 1954 experiments) indicated a two-to-one return per dollar spent on nitrogen for the first 40 pounds of N applied per acre, then about 1.5-to-one for the second 40 pounds of N per acre. Then, lower and lower returns were estimated for the higher rates of N.

Although it is unfortunately true that returns from application of nitrogen on annual ryegrass seed are not as high as formerly because of the nearly 300 percent increase in N prices, it still should usually pay to apply 20 pounds of N in the fall and at least 60 pounds of N in the spring, according to the experimental results. If no N is applied at all, yields could be so low as to hardly cover harvesting costs.

Returns per dollar expended on fertilizer varied greatly on the other grass seed experiments analyzed, ranging from a low of about "breaking even" to as high as four-to-one, depending upon the grass seed price and the response to fertilizer.

Since prices of grass seed for the 1975 crop are not yet known, final decisions on fertilizer application rates should take into consideration each grower's expectation of prices to be received. Also, because of the uncertainty concerning

---

* Department of Agricultural Economics, Department of Soil Science, and Department of Crop Science, respectively. Helpful comments and suggestions by Grant E. Blanch are appreciated.

grass seed prices, the grower may want to leave a reasonable margin for possible error in his price expectations.

In conclusion, the annual application of nitrogen fertilizer to grass seed crops is an essential practice in economic seed production. However, efficient use of nitrogen fertilizer is influenced by rate and time of application. Research results have shown that mid-winter application (January and February) will stimulate early plant growth and straw production but not increase seed yield as efficiently as will a March or April application. Late applications must allow for expected rainfall to carry the fertilizer into the root zone during the growing season.

## APPLICATION OF NITROGEN FOR GRASS SEED PRODUCTION - DOES IT STILL PAY?

Rapid reductions in grass seed prices in 1974, coupled with 300 percent increases in nitrogen fertilizer costs during the past two years, have justifiably caused many grass seed growers to wonder if it still pays as much to apply nitrogen and other fertilizer for grass seed production. Although profit margins from fertilizer application have been greatly reduced, nitrogen application does appear to still be profitable, but application rates often should be reduced below the rates reportedly used by some growers in previous years.

Profitability of at least some nitrogen application, even under the unfavorable price-cost conditions of early 1975, can be illustrated by simple economic analysis of some past experiments conducted by the Department of Soil Science.

### Costs and Returns from Application of Nitrogen to Annual Ryegrass Grown on Dayton Soil, Based Upon 1953 and 1954 Fertilizer Trials

It should be noted that some growers may obtain somewhat higher yields and nitrogen responses than the yields and responses shown in Table 1. Nevertheless, the 1954 experimental yield increases should still be useful as a conservative guide for nitrogen application under low to average conditions.

Total yields and increased pounds of annual ryegrass seed per acre for each 40-pound increment of applied nitrogen are shown in Table 1 for four levels of nitrogen. According to these results, the lowest yield response occurred in 1954 for the second farm listed in Table 1. But even for this lowest response, an average of about 785 - 300 = 485 pounds of seed could be obtained from 80 pounds of N.

Although fertilizer prices for 1975 are reasonably firm and known, the prices of grass seed for the 1975 crop are not yet known. Therefore, final decisions on fertilizer application rates should take into consideration each grower's expectation of prices to be received. Also, because of the uncertainty concerning grass

Table 1. Yields and Increases in Yields, in Pounds Per Acre, of Annual Ryegrass Seed at Various Levels of Nitrogen and on Different Farms (Clean Seed Equivalent)

| Farm and year | Total yield in pounds per acre | | | | |
|---|---|---|---|---|---|
| | Zero level of N | 1st 40 lbs. (N = 40) | 2nd 40 lbs. (N = 80) | 3rd 40 lbs. (N = 120) | 4th 40 lbs. (N = 160) |
| Pugh, 1953......... | 347 | 914 | 1,206 | 1,471 | -- |
| Davidson, 1954..... | 300[a] | 603 | 785 | 950 | 1,160 |
| Garwood, 1954...... | 300[a] | 790 | 1,079 | 1,360 | 1,497 |
| Pugh, 1954......... | 300[a] | 940 | 1,144 | 1,310 | 1,390 |
| Average yield...... | 312 | 812 | 1,054 | 1,273 | 1,349 |
| Ave. increase in yield........... | --- | 500 | 242 | 219 | 142[b] |

a/ Check plot yields of 300 pounds were estimated from previous research. (Check plot yields were not estimated directly because of the weed problem on unfertilized areas.)

b/ Based upon the three 1954 experiments only.

<u>seed prices, the grower may want to leave a reasonable margin for possible error in his price expectations</u>.

To illustrate this point, suppose that a grower had a yield response to nitrogen similar to the second farm of Table 1. If he expected annual ryegrass seed to be worth about \$0.10 per pound, then value of increased yield would be about \$0.10(485) ≐ \$48 per acre from 80 pounds of N. Cost of elemental N is expected to be around \$0.30 per pound if urea is used. Cost of 80 pounds of N from urea would then be about \$0.30(80) = \$24, and cost of application could raise the cost to around \$26 or \$27 per acre. Thus, the expected margin over nitrogen cost would be only about \$21 per acre. But the cleaning and bagging of the extra 485 pounds of seed per acre would add \$1.50(4.85) ≐ \$7 per acre. Therefore, net margin over fertilizer cost would be only about \$48 - \$34 = \$14 per acre. (Remember, however, that the second farm in Table 1 gave the lowest response to N.)

Probably a much better estimate of expected pounds of seed per 40-pound increment of nitrogen is given by the average yield increases (bottom line of numbers in Table 1). It would still pay to apply at least 40 pounds of N, even with lower than present annual ryegrass seed prices and high nitrogen costs. However, the highest levels of application do become less profitable.

For sake of illustration, suppose that a farmer applied 100 pounds of ammonium sulfate per acre in the fall, supplying about 20 pounds of N per acre plus the included sulfur, then added 20 pounds of N in the spring as urea. If the ammonium sulfate cost about \$0.40 per pound of N and the urea cost \$0.30 per pound of N, then the cost of N would be about $\$0.40(20) + \$0.30(20) \doteq \$8 + \$6 = \$14$. Cost of application might add an additional \$2 or \$3 per acre, giving a total fertilizer cost of around \$16 or \$17 per acre. According to the average increase in yield per 40-pound increment of N in Table 1, increased yield would be about 500 pounds of seed per acre. At a price of \$10 per hundredweight, value of increased seed from N would be $\$0.10(500) \doteq \$50$. However, cleaning and bagging could increase costs by about $\$1.50(5) \doteq \$7$ per acre, giving $\$50 \div \$24 \doteq 2$, or more than a two-to-one return.

A higher margin over fertilizer cost, but a lower rate of return, would be obtained under the same prices for the second 40 pounds of N (applied in the form of urea). If the second 40 pounds applied cost \$0.30 per pound of N, or $\$0.30(40) = \$12$ per acre, the average increased production would be about 242 pounds of seed per acre, worth $\$0.10(242) \doteq \$24$ per acre. Cleaning and bagging costs of the extra seed would add almost \$4 per acre to costs. Thus, the return per dollar of N would be $\$24 \div \$16 = 1.5$, less than the two-to-one return for the first 40 pounds applied, but still profitable.

The effect of seed prices on optimum nitrogen level can be seen from Table 2. If the grower expected the low seed price of \$0.07 per pound and the average increase in yield from Table 1, then only about 80 pounds of N would be profitable. (Probably some growers can get somewhat more than 219 pounds of seed from the third 40 pounds of N, however.)

Table 2. Margin Per Acre Over Nitrogen and Associated Costs[a] for Various Levels of N and Various Annual Ryegrass Seed Prices, Based Upon Average Yield Increases from N Shown in Table 1

| Level of N | | Assumed annual ryegrass seed price $0.07 | $0.10 | $0.13 |
|---|---|---|---|---|
| 1st 40 lbs. of N | Gross value of increase | $35.00 | $50.00 | $65.00 |
| | Added cost[a] | 21.50 | 21.50 | 21.50 |
| | Margin over costs | $13.50 | $28.50 | $43.50 |
| 2nd 40 lbs. of N | Gross value of increase | $16.94 | $24.20 | $31.46 |
| | Added cost[a] | 15.63 | 15.63 | 15.63 |
| | Margin over costs | $ 1.31 | $ 8.57 | $15.83 |
| 3rd 40 lbs. of N | Gross value of increase | $15.33 | $21.90 | $28.47 |
| | Added cost[a] | 15.28 | 15.28 | 15.28 |
| | Margin over costs | $ 0.05 | $ 6.62 | $13.19 |
| 4th 40 lbs. of N | Gross value of increase | $ 9.94 | $14.20 | $18.46 |
| | Added cost[a] | 14.13 | 14.13 | 14.13 |
| | Margin over costs | $-4.19 | $ 0.07 | $ 4.33 |

[a] Nitrogen was assumed to cost $0.30 per pound of elemental N plus $2 per acre for application, cleaning to cost $1 per hundredweight, and seed bags to cost $0.50 per hundredweight.

At $0.10 per pound for ryegrass seed, up to 120 pounds of N would be profitable. If the grower is optimistic and expects $0.13 per pound for the 1975 crop, then the higher rates of N should be applied.

It should be noted that the above economic analysis is in basic agreement with recommended nitrogen application rates for annual ryegrass seed production in Western Oregon.[1/] According to the University recommendations, 15 to 20 pounds of nitrogen per acre should be applied in the fall at planting time to provide seedling vigor. (Higher rates of fall-applied N will produce more feed on pastured fields.) Then 80 to 100 pounds of N per acre are recommended between April 1 and May 15, after grazing is completed. (Recommendations for phosphorus (P), potassium (K), and lime are also given, depending upon soil test readings.)

Although it is unfortunately true that returns from application of nitrogen on annual ryegrass seed are not as high as formerly because of the nearly 300 percent increase in N prices, it still should usually pay to apply 20 pounds of N in the fall and at least 60 pounds of N in the spring, according to the experimental results in Table 1. If no N is applied at all, yields could be so low as to hardly cover harvesting costs.

## Costs and Returns from Application of Nitrogen to Bentgrass, Based Upon 1954 Fertilizer Trial in Marion County

This fertilizer experiment was with Bentgrass grown on Aiken soil series (a "hill" soil), and the field plots were on the Doerfler farm in the Silverton area. According to the results of this experiment, shown in Table 3, a yield increase of about 94 pounds of seed per acre was obtained with the second 40 pounds of N. (No estimate of yield increase from the first 40 pounds was possible because of no check plot yields; however, the yield increase from the first 40 pounds should have considerably exceeded the second 40-pound increment, due to the principle of diminishing returns.)

---

1/ Cooperative Extension Service, Oregon State University Fertilizer Guide for Annual Ryegrass Seed (Western Oregon-West of the Cascades), FG 5, January 1970.

Table 3. Yields of Bentgrass Seed (Clean Seed Equivalent) and Estimated Margins Over Nitrogen Costs, Assuming Per-Pound Costs Are $0.30 for N Plus $2 Per Acre for Application, Cleaning Costs $3 Per Hundredweight, Bags Cost $0.50 Per Hundredweight, and Bentgrass Seed is Worth $0.26 Per Pound

| Pounds of N | Average yield in pounds per acre | Yield increase beyond 40 lbs. N per acre | Estimated margin over additional cost of N per acre |
|---|---|---|---|
| 40 | 346 | -- | -- |
| 80 | 440 | 94 | $ 7.15 |
| 120 | 409 | 63 | $-11.82 |

If Bentgrass seed were worth $0.26 per pound, then $0.26(94) = $24.44. Thus, if nitrogen could be obtained for $0.30 per pound of elemental N, the second 40-pound increment would cost $0.30(40) = $12 per acre, plus $2 or more for application. Cost of cleaning and bagging would add $0.035(94) ≐ $3 per acre. Thus, the margin over cost of N would be about $24 - $17 ≐ $7 per acre, as shown in Table 3. Thus, the experiment indicates that 80 pounds of N per acre would be profitable under these soil, price, and yield conditions. However, a third 40-pound increment of nitrogen would not be profitable, since 120 pounds of N gave a lower yield than the 80-pound level of N.

The preceding experimental results indicate a slightly lower level of N than the Oregon State University Fertilizer Guide for Highland Bentgrass Seed of the Cooperative Extension Service, FG 7, January 1970, which recommends that 20 to 30 pounds of N per acre be applied in the fall, and 80 to 100 pounds of N per acre be applied in the spring - in late March or in April. Since the OSU fertilizer guide is based upon all available past experiments, plus observation and experience with farm yields, the recommended rates should be much more reliable than the results of the single experiment discussed here. However, with present shortages and high prices of N, Oregon grass seed growers may find it profitable to lower their application rates somewhat from previous years. (Some grass seed producers reportedly have applied higher rates in the past than those recommended by the OSU fertilizer guides.)

## Costs and Returns from Application of Fertilizer to Orchardgrass, Based Upon Two Experiments 1/

### Experiment No. 1 on Woodburn Silt Loam

If Orchardgrass is grown in closely drilled stands, then increases in seed yields were reported with rates of N as high as 120 pounds per acre, as shown in Table 4.

Table 4. Five-Year Average Yields of Cleaned Orchardgrass Seed and Estimated Margins Over Cost of N, Assuming N Costs $0.30 Per Pound Plus $2 Per Acre for Application, Cleaning and Bagging Costs $4.50 Per Hundredweight, and Orchardgrass is Worth $0.28 Per Pound

| Pounds of N per acre | 5-year average yield in pounds per acre | Yield increase from N | Estimated margin over cost of N per acre |
|---|---|---|---|
| 0 | 157 | --- | --- |
| 40 | 342 | 185 | $29.48 |
| 80 | 533 | 376 | $62.36 |
| 120 | 636 | 479 | $74.56 |
| 160 | 558 | 401 | $44.24 |

Highest margin over cost of N in Table 4 was $74.56 per acre for 120 pounds of N. However, average yield and margin over cost of N were reduced at the 160-pound level of N.

1/ Reported by H. H. Rampton and T. L. Jackson, Orchardgrass Seed Production in Western Oregon, Ore. Agr. Exp. Sta. Tech. Bul. 108, Corvallis, October 1969.

## Experiment No. 2 On a Soil Very Low in Phosphorus

This experiment was established in October 1959 on gently sloping Willakenzie clay loam that was known to be very low in nitrogen and available phosphorus.[1/] Yields and estimated margins over fertilizer cost are shown in Table 5. (This location was selected because it had a very low phosphorus soil test value, and the possible effect of phosphorus on seed germination was being investigated.)

Table 5. Experimental Yields and Estimated Margins Over Fertilizer Cost, Assuming N Costs \$0.30 Per Pound, $P_2O_5$ Costs \$0.25 Per Pound, and Orchardgrass Seed is Worth \$0.28 Per Pound

| N | $P_2O_5$ | 3-yr. ave. seed yields per acre | Yield per acre increase over no fertilizer | Estimated margin over fertilizer cost per acre a/ |
|---|---|---|---|---|
| | | Pounds | | (\$) |
| 0 | 0 | 319 | --- | --- |
| 80 | 40 | 536 | 217 | 17.00 |
| 80 | 80 | 606 | 287 | 23.44 |
| 80 | 160 | 712 | 393 | 28.36 |
| 160 | 40 | 629 | 310 | 14.85 |
| 160 | 80 | 706 | 387 | 22.94 |
| 160 | 160 | 765 | 446 | 16.81 |

a/ Fertilizer cost also includes a charge of \$4.50 per hundredweight to cover the cost of cleaning and bagging the increased yield from fertilizer.

Although the response to nitrogen and phosphorus became more pronounced in the second and third year of production, only the average yields over the 3 years are considered here. Based on the 3-year averages, the treatment with 80 pounds of N and 160 pounds of $P_2O_5$ appeared to be one of the most profitable. Increased

1/ H. H. Rampton and T. L. Jackson, *ibid.*, pp. 20-23.

yield due to N and $P_2O_5$ would be 712 - 319 = 393 pounds of seed. Assuming N to cost \$0.30 per pound, $P_2O_5$ to cost \$0.25 per pound, Orchardgrass seed to be worth \$0.28 per pound, and cleaning and bagging to cost \$0.045 per pound, then margin over fertilizer cost would be:

$$\$0.235(393) - \$0.30(80) - \$0.25(160) \doteq \$92 - \$24 - \$40 \doteq \$28 \text{ per acre.}$$

However, the treatment with 80 pounds of N and 80 pounds of $P_2O_5$ would also be reasonable, giving a margin over fertilizer cost per acre of:

$$\$0.235(287) - \$0.30(80) - \$0.25(80) \doteq \$67.44 - \$44 \doteq \$23.$$

A return of about \$67 ÷ \$44 ≐ 1.5 to one on fertilizer cost would be estimated for the preceding fertilizer treatment.

The preceding economic analysis is in fairly close agreement with the OSU Fertilizer Guide for Orchardgrass, FG 45 of the Cooperative Extension Service, revised November 1969. The Guide recommends 50 to 60 pounds of N per acre about March 1 and a similar amount around April 1. Of course, if Orchardgrass is to be pastured during the winter, 30 to 40 pounds of N per acre, applied in the fall, would increase the growth for grazing. Recommendations for phosphorus, potassium, and lime are also given in the OSU Fertilizer Guide for Orchardgrass Seed, FG 45, and needed application of these elements depends upon the soil tests for the individual fields. (As mentioned earlier, the yields in Table 3 were from a field which was unusually low in phosphorus. Such high response to P would not be obtained on most farms.)

## LIMITATIONS AND NEEDED RESEARCH

An obvious limitation of this report is the analysis of only a few experiments at a time or, in some cases, the analysis of a single experiment. A more generalized approach should be undertaken where many experiments could be incorporated into one model that would predict the effect of many variables (such as soil test readings for various nutrients and climatic factors) upon yield. Then a much better basis for evaluating the effect of changing prices and costs upon optimal fertilizer usage could be obtained. However, in the short time available for this study, such an approach was not possible.